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Printing Wool Fabrics with Natural Dyes Curcuma and Alkanet (A Critique)

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GREEN printing of wool textiles utilizing green print Paste with natural alkanet dye nanoparticles. The ball-milling technique provides an effective way of generating alkanet-nano particles dye at room temperature and pressure in one step. In this research, we study the effect of alkanet alone and Curcuma dye alone on wool fabric in natural size and nano size and comparing among them. studying K/s of the samples and the properties of fastness. we study the ball milling method to get nanoparticles of alkanet dye. we study the effect of mordants that are attached to fibers before or post-printing of wool fabrics. Regardless of the textile used, nano samples have a K/S value greater than the basic samples. Nano-Curcuma can be replaced for alum mordant with normal Curcuma. K/S values of pre-mordant gained values that were above the simultaneous mordant, regardless of the fabric or size of dye or the quantities of Curcuma in the usage of tannic acid mordant.

Keywords: Wool, Nanoparticles, Alkanet dye, Curcuma.

Introduction

Wool is an essential protein-rich fiber with warming preservation and high resistance to abrasion which is one of the most important raw resources for the industrial sector. Furthermore, wool Peels prevent the entry and dissemination of dye and promote sinter **[1]**.

Pigments generated from plant, animal, and mineral sources are natural dyes **[2]**. They are more environmentally friendly than manufactured colors are more biodegradable and usually contain a greater degree of environmental adaptability **[3-7].** As mordant agents, metallic salts generate a connection among the dye molecules and the fiber by the formation of coordinating interactions **[8]**.

Alkanet plant from Boraginaceae household and endemic to the Mediterranean area. (Anchusa officinalis L.). The root of the alkanet is used as red natural coloring. It's turned out to be dark crimson. Its coloring granules are water-insoluble and organically dissolves in solutions including ether, alcohol, and oils **[9]**.

Mordants are linked both to textile and dyes and hence connected the dyestuff with the fiber **[9, 10]**. They may thus be employed to improve color absorption and fixation that changes the shade of color and the characteristics of stability **[11, 12]**. The mordants' metal ions can function as electron suppliers hence rendering them insoluble in water and forming coordination connections with dye molecules **[13, 14]**.

Nanotechnology is a recent scientific subject working with 1-100 nm nanoparticles. About the textile business, nanotechnology provides a new and exciting technique to produce novel textile materials for technical and smart usage **[15, 16]**. The surface-to-volume ratio for nanoparticles

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provides them new attractive morphology in the textiles industry **[11, 16]**.

Ball milling is a top-down method for forming substances of micro to nanoscales that lead to strong cyclic material deformations. Ball milling has recently become frequently utilized in nanoparticle production as it is easy to use, is reasonably affordable, and can be applied in virtually all material classes **[17]**.

Curcuma longa L. was used for painting and also for medical purposes as the recognized Curcuma longa L. The Sub-Continent of India is part of the family of Zingiberaceae but is now widely cultivated in the tropics and perhaps surrounding parts of south-east Asia. Their tuberous rhizomes have been utilized since ancient times as condiments, dyes, and aromatic stimulants. The pigments in colorant extracts from turmeric, known as curcuminoids, are the main components of curcumin and tiny quantities of dimethoxy curcumin. The yellow hue of the dye is reportedly responsible for curcumin and other associated curcuminoids. The colors, which are water-insoluble but soluble in organic disrupters, like acetone, ethanol, and hexane, are due to the curcumin. Antiviral, antigung, and anti-tumor Curcumin is anti-inflammatory **[18]**.

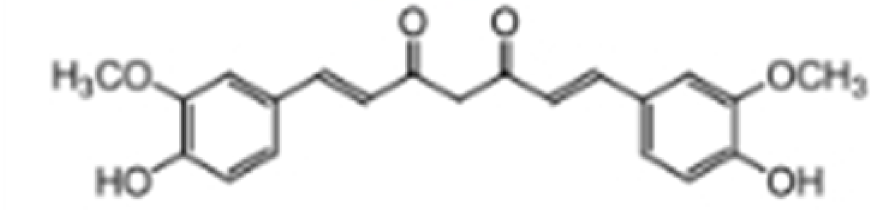

Fig. 1. chemical structure of Curcumin.

Alkanet Wool Printing Dyes

In this study, nanoparticles were prepared for printing textiles like wool from alkanet dye through a ball milling process. Firstly, dyes were prepared in nano shape, then mordanting the fiber by using tartaric acid in the bath of mordanting at L: R 1:40 at 50-60°C for 30 min. The sample was rinsed and air-dried with distilled water. The wool textiles can be changed to generate the appropriate ester and amide derivatives by their interaction with tartaric acid **[19, 20]**. The reaction is done in physical uptake at 50-60°C, and in a steam fixation operation at 120°C the chemical reaction occurs. This creates a more dynamic site (hydroxyl and carboxylic groups in addition to native groups in wool fabrics) **[9]**.

In this research, the effect of alkanet alone and Curcuma dye alone on wool fabric in natural size and nano size and comparing among them were studied. studying the K/S of the samples and the properties of fastness. The ball milling method to get nanoparticles of alkanet dye and the effect of mordants that attached to fibers before or post-printing of wool fabrics were also observed.

Textiles have a firm H site, with only one alkane dye whereas links with three mol alkane dye cause forming three sites have which can create greater H.. Raised mordant content resulted in an enhancement in the pigment impact and color depth up to 60 g/l. Furthermore, the response attachment of wool materials is due to the creation of amide bonds, reflecting the difference in color efficiency and the fastness properties of printed materials **[9]**.

Various variables like the optimization of printing are analyzed (Mordanting of Substrates, thickeners type, urea concentration and pH of printing paste for first paste and urea concentration, pH of printing paste and binder concentration for second paste). The textiles produced have been viewed by colorimetric parameters.

In addition to Diammonium phosphate, the pH for the pastes is adjusted for the first paste using Sodium carbonate and the second paste with Diammonium phosphate. The first paste is fixed for 20 minutes for wool by steaming at 105°C. The second paste is made at 160°C for 4 min with thermo-fixation. Post fixation methodology, the material is wetted in cold water washed with 2 g/l non-ionic surfactants at a liquor ratio of 1:50. for 15 min at 40°C **[9]**. Grinding improves the particular surface area of nanoparticles of the alkanet by reducing the particle size **[21]**. Ultrasound is an effective technology for reducing nanoparticle size **[22]**.

The first paste recipe (dye printing)		The second paste recipe (pigment printing)	
Natural dye	50 g	Natural dye	50 g
Thickener	600 g	Thickener	600 g
Urea	X g	Diammonium phosphate	X g
pH Adjusting		Binder	Y g
Water	Z g	Urea	Z g
Total	1000g	Total	1000g

In the first recipe

The greatest K/S value was achieved by employing the thickening CMC. Urea regarded most printed pastes as an important aid due to their capacity to enlarge materials that quicken the penetration of the dye into the textiles **[23]**. It functions as a solvent for the coloring ingredient and speeds up dye movement from the thickener to textiles. It also acts for moisture-absorbing substances. And the colors with various amounts of urea and the optimum ratio were 150 g, which offered the greatest color depth and better chromatic depth than untreated textiles. And for the rate of coloration, the pH of the printing paste plays an important role. The percentage of lower pH values of dye concentration and ammonium ion sites has grown **[24]**. The impact on the K/S standards of printed wool (pretreated with tartaric acid) on alkanet nanoparticles is examined using various values. At pH 5.5 for wool, optimal K/S ratios were obtained.

For the second paste

The pH of the printer paste is a long-term color difference factor, The pH of 6 allows for maximal K/S levels. The greatest K/S levels are present in wool materials without urea. This might be due to the expanding characteristics of the urea that contributes to color fixing. In the existence of diammonium phosphate as catalysis, the binding here is dependent on the binder. Diammonium phosphate catalysis can encourage the cross-linking process which leads to the binder fixation to the cloth. At 160°C for 4 minutes diammonium phosphate modify medium pH at 6. The binder can be chemically bonded on the textiles and dyeing with this value. Throughout most cases, 140 g/kg of the binder achieved the greatest K/S values **[9]**.

Printed materials show good to outstanding rapidity qualities using alkanet coloring nanoparticles for coloration (the first combination) and extremely good to exceptional fastness qualities when employing alkanet colors, nanoparticles like pigments (second recipe). For all printing textiles of the second pigment recipe, the color quality of K/S values is better than that of fabrics printed with the first coloring recital **[9]**.

Nanotechnology for the printing of wool textiles with natural Curcuma

Curcuma was added to 1000 ml of water for 100 g powder form and boiled for 30 minutes in reflux. At room temperature, the mixture was permitted to cool and then filtered out.

various quantities “X” (3, 5, or 7gm) of Curcuma were hanged in filtered solution into the 100ml distilled water, The solution in the Ultrasonic Stirrer was then moved to stirring. To achieve a nano-size, the ultrasonic stirrer worked 60 min at 80°C.

The Curcuma color was minimized using the previously described ultrasonic agitator. Various pastes with natural Curcuma colors were produced according to the following recipe before and after minimization:

Dye suspension original or nano sample	20 g
Urea	2.5g
Thickener	2.5g
Binder	5g
Sodium dihydrogen phosphate dehydrate	0.5g
Mordant	X
Distilled water	Y
Total	100g

Twenty g of every solution containing Curcuma (original or Nano-sized) at 3, 5, or 7 g dye in 100 ml water were taken from each dyeing solution. The mordant was added to the printing paste directly.

Wool textiles have been mordanted by two different techniques. Wool fabric was printed using screen-printing technology with the produced printing paste. After printing and dyeing, steamed products at 115°C for wool for 20 minutes, washed completely, and then air-dried. The textiles were finally evaluated for the K/S characteristics and total fastness **[18]**.

It was observed that the best ratio, dispersion, and broadly dispersed was the lower percentage, which is 3 % in nanosize when the dye molecules were converted to nano size, and whenever molecules were viewed and their dispersion under a microscope before conversion and transformation.

To get the best richness of color. It was observed that a considerable enhancement of color strength because of the reduction of particle size. The nano-pigments are characterized by a greater surface area, which allows for a richer color depth and a good spreading and fast penetration to the surface.

Natural dyes are marked by a large molecular weight of substances containing hydroxyl quinol groups to create cross-links with proteins like wool. They establish links to wool, for example, i) Hydrogen bonds: Produced among both the amino and amide groups of wool and phenolic hydroxyl, (ii) Ionic bonds: Produced among the suitable anionic groups charged in the natural color and the protein cationic groups and (iii) Covalent bond: It consists of the interaction between a group of quinones or semiquinones, which are present in the natural coloring of the protein with an appropriate reactive group.

Rather than utilizing a natural dye and fixing Mordant, they utilized a nano dye to examine wool materials printed simply with dye and others printed with ordinary dye molecules coupled with Mordant. A comparison was conducted utilizing conventional dye, nano dye, and nano dye with 5 percent concentration in combination with Mordant. The maximum color richness was only without Mordant when nano dye was used.

When alum mordant with varying levels of conventional dye was used, the optimum color depth was when 7 percent of the dye was used, and it was better to pre mordanting the fabric before printing with turmeric while utilizing it with the nano size.

The color depth of pre-mordant was the strongest when tannic acid was used with conventional dyes or dyes in nano-sizes before printing with turmeric.

The stability characteristics vary from very good to excellent, before or after the pigment particles are decreased, but the significant increase in sweat stability following a reduction in the pigment particles was **[3, 18]**.

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طباعة أقمشة الصوف بالأصباغ الطبيعية الكركم والكانيت (نقد)

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طباعة خضراء على منسوجات الصوف باستخدام معجون الطباعة الخضراء مع جزيئات نانوية صبغة الكانيت الطبيعية. توفر تقنية طحن الكرة طريقة فعالة لتوليد صبغ جزيئات الكانيت النانوية في درجة حرارة الغرفة وضغطها في خطوة واحدة. في هذا البحث قمنا بدراسة تأثير الكانيت وحده وصبغة الكركم وحدها على نسيج الصوف بالحجم الطبيعي والحجم النانوي والمقارنة بينهما. دراسة **K / s** للعينات وخصائص الثبات. ندرس طريقة طحن الكرة للحصول على جزيئات نانوية من صبغة الكانيت. ندرس تأثير الموردات التي تعلق على الألياف قبل أو بعد طباعة أقمشة الصوف. بغض النظر عن النسيج المستخدم ، تحتوي عينات النانو على قيمة **K / S** أكبر من العينات الأساسية. يمكن استبدال **Nano-Curcuma** بـ **Alum mordant** بالكركم العادي. اكتسبت قيم **K / S** لقيم ما قبل **mordant** التي كانت أعلى من الصوت المتزامن ، بغض النظر عن نسيج أو حجم الصبغة أو كميات الكركم في استخدام حمض التانيك الهائل.

الكلمات الرئيسية: صوف؛ الجسيمات النانوية. صبغة الكانيت كركم